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ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: INFORMATION GUIDE FOR AIR CARRIER HANDLING OF RADIOACTIVE MATERIALS PACKAGES

1. PURPOSE. This circular is intended to acquaint air carrier industry and in particular, air freight handling personnel; with the essential requirements and practical application of the various regulations pertaining to the handling and transportation of radioactive materials. It is also intended to provide a reference source to assist interested persons in obtaining additional in-depth information. This circular does not cover the handling of incidents, i.e., mishaps, involving radioactive materials packages or shipments, nor any aspects of military shipments of nuclear weapons on military aircraft. These matters are treated in AC 150/5240-6A, entitled "Radiation Safety for Civil Airports," Rev. 1965.

2. DISCUSSION AND BACKGROUND.

   a. Since the beginning of the relatively young atomic energy industry, i.e., about 3 decades, there has been an excellent record of safety in the transportation of millions of packages of radioactive material. Recent estimates indicate that current shipments involve approximately 500,000 packages of radioactive materials per year in the U.S.A. Thus far, based on best available information, THERE HAVE BEEN NO KNOWN INJURIES OR RADIATION OVEREXPOSURES TO THE PUBLIC OR TO THE TRANSPORTATION INDUSTRY PERSONNEL AS A RESULT OF THESE SHIPMENTS. This fact can be attributed to the close attention which has generally been given by the shippers to the proper packaging of radioactive materials, and to the effectiveness of the safety standards and regulations applicable to their transportation.

   b. The current status of the private segment of the nuclear industry in the U.S.A., is such that the vast majority of the current shipments of radioactive materials involves small or intermediate

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quantitives of material in relatively small packages. Most of these packages involve radioisotopes which are intended for medical diagnostic or therapeutic applications by thousands of doctors and hospitals throughout the U.S.A. and its possessions. Such materials are most often of very short "half-life," 1/ and therefore must be supplied by the producer to the user via the most rapid available means of transportation. It, therefore, follows quite logically that the vast majority of these packages will involve air freight or air express via passenger-carrying or cargo-only aircraft.

c. Notwithstanding the excellent past record of safety, the term "radioactive" unfortunately conveys to the average person an extremely confusing and a very often frightening connotation. The memory of the devastating destruction and violent deaths which were the aftermath of the use of the atomic bomb near the end of World War II is still very vivid in the minds of many. The more recent confusion regarding the effects of nuclear power plants on the environment and the ecology have also added to this aura of fear. Nuclear radiation and its potential effects are more frequently thought of by the average layman or uninformed person as a threat of some type of horrible destruction. THIS CONCERN HOWEVER HAS PROVEN TO BE COMPLETELY UNWARRANTED AS RELATED NOT ONLY TO THE SAFE USES OF NUCLEAR ENERGY IN INDUSTRY, BUT ALSO TO THE SAFE TRANSPORTATION OF RADIOACTIVE MATERIALS. THE RECORD OF SAFETY IN TRANSPORTATION OF THESE MATERIALS FAR EXCEEDS THAT FOR ANY OTHER REGULATED HAZARDOUS COMMODITY.

d. Experience has also shown, however, that air freight handlers, carrier management, flight operations personnel, and any other involved persons could benefit from a practical, non-technical reference guide to the applicable regulations pertaining to transportation of radioactive materials.

3. SOURCES OF RADIOACTIVE MATERIALS TRANSPORTATION REGULATIONS.

a. The U.S. Department of Transportation (DOT) has the regulatory jurisdiction for the safe transportation in interstate and foreign commerce of all hazardous materials, including radioactive materials, by all modes of transport (air, highway, rail, or water), except postal shipments, which are under the jurisdiction of the U.S. Post Office Department. Within the DOT, the various operating administrations, i.e., Federal Aviation Administration (FAA), Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and the U.S. Coast Guard (USCG) retain direct

1/ The "half-life" of a radioactive material is the length of time that any quantity of the material will take to discharge half of its radioactivity. The period of time is different for each different material.

regulatory authority for each respective mode of transport. Intermodal regulatory matters are coordinated through the DOT's Hazardous Materials Regulations Board, which is composed of members of each of the above-named operating administrations, DOT General Counsel, and the Office of Hazardous Materials. The latter office is functionally within the Office of the Assistant Secretary for Advanced Systems Development and Technology.

b. The various regulations of the DOT, pertaining to the shipment of Hazardous Materials, including radioactive materials are published in the Code of Federal Regulations (CFR) as follows:

Mode	CFR
Air	Title 14 Part 103
Highway, Rail	Title 49 Parts 170-189
Water	Title 46 Part 146

c. In regard to air transportation most of the regulations specific to transportation of radioactive materials are accomplished by reference to the appropriate sections of 49 CFR.

d. Other agencies or organizations which publish regulations or tariffs on transportation of radioactive materials are as follows:

(1) Airline Publishers, Inc., Agent "Official Air Transport Restricted Articles Tariff No. 6-D."

(2) International Air Transport Association (IATA), "IATA Restricted Articles Regulations," 12th Edition, 1969.

(3) International Atomic Energy Agency (IAEA) "Regulations for the Safe Transportation of Radioactive Materials," Safety Series #6, 1967 Edition.

(4) U.S. Atomic Energy Commission, Title 10 CFR 71 "Packaging of Radioactive Material for Transport."

(5) Bureau of Explosives, Assn., of American Railroads, Agent T. C. Georges Tariff No. 23, "Hazardous Materials Regulations of the Department of Transportation, Including Specifications for Shipping Containers," issued August 3, 1969.

(6) American Trucking Association, Inc., Dangerous Articles Tariff No. 14, "Department of Transportation Regulations for Governing Transportation of Hazardous Materials by Motor, Rail, and Water, Including Specifications for Shipping Containers," issued October 31, 1969.

e. Throughout this guide, regulatory references will be made to specific sections of the pertinent Code of Federal Regulations. These references will be to Title 49, unless otherwise indicated.

4. SHIPPERS' REQUIREMENTS IN PREPARATION AND OFFERING OF RADIOACTIVE MATERIALS PACKAGES FOR SHIPMENT.

a. General Information. This paragraph of the guide is intended to provide detailed information and references to the SHIPPERS' requirements. Such information will be useful to carrier handling personnel by bringing into perspective the shippers' requirements for proper packaging as opposed to the requirements for the carrier, which are discussed in paragraph 5. This discussion will also serve to aid carriers in detecting cases of shippers' non-compliance.

b. Selection of Proper Packaging by the Shipper. Before offering a package of radioactive material to a carrier for transportation, the shipper must observe and consider many factors relating to the packaging, marking, and labeling. These requirements are summarized by the following questions which he must resolve in advance of shipment.

(1) Is the material "radioactive material" by definition? (§ 173.389(e)).

(2) WHAT radioactive material is being shipped?

(3) In what FORM is the material? Is it in "normal form" (§ 173.389(d)); or is it in "special form" (§ 173.389(g))?

(4) Having determined the identity and form of the material, the shipper must then determine the quantity allowable in specific types of packaging. "Normal form" materials are categorized into seven "Transport Groups" (§ 173.389(i)) in a table of several hundred different radioactive materials (§ 173.390). Packaging limits for "Type A" packaging or "Type B" packaging are then established (§ 173.389(l)). Packaging limits for small or "exempt" packages (exempt from specification packaging, marking and labeling) are also provided (§ 173.391). "Type A" packaging (§ 173.389(j)) is defined as that packaging which must be designed to withstand certain "NORMAL" conditions of transportation (§ 173.398(b)) without loss of contents; as opposed to "Type B" packaging (§ 173.389(k)) which must be designed to withstand hypothetical ACCIDENT conditions, (§ 173.398(c)), without loss of contents. "Large quantities" (§ 173.389(b)), defined as those quantities exceeding "Type B," and "fissile radioactive materials" (§ 173.389(a)) present more unusual and specific packaging problems. These materials are additionally controlled by the packaging standards as

promulgated by the U.S. Atomic Energy Commission in its Title 10 CFR Part 71, as well as the provisions of § 173.394(c), § 173.395(c), or § 173.396 of Title 49.

c. Other Shipment Requirements. Having selected the proper packaging for the specific contents, the shipper must check for compliance with the following:

(1) Radiation dose rate - the maximum radiation dose rate at the surface of the package and at three feet (Transport index) may not exceed certain levels (See §§ 173.393(i) and (j)).

(2) Surface Contamination - loose radioactive contamination on the outside of the package may not be "significant" (See §§ 173.393(h) and 173.397).

(3) Labels - at least two appropriate radioactive materials warning labels, unless the package is exempt, must be affixed to opposite sides of the package. Either of three labels, as illustrated in Appendix 1 hereto are used based on the levels of radiation at the packages surface and at three feet, (Transport index) (See §§ 173.399, 173.402, and 173.414). The method of determination of the transport index is described in § 173.389(i)).

(4) Other package markings - the outside of the package must also be marked with the appropriate specification number (See § 173.34(c)(i)) or special permit number, if applicable, and also with the proper shipping name as shown in the commodity list (See §§ 173.401 and 172.5).

(5) Shipping Papers - certain essential elements of information must also be included in the shipping paper description (See § 173.427).

(6) Shippers' Certification - the shipping papers must include a certificate signed by the shipper, which reads as follows: "This is to certify that the above-named articles are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation." (See §§ 173.430 and 103.3). In the case of shipments in passenger-carrying aircraft, the certificate must also state that the shipment complies with the requirements for passenger-carrying aircraft. Under FAA regulations, (§ 103.9), any packages which are exempt from the packaging, marking, and labeling requirements of 49 CFR for shipments by rail express are also authorized for shipment by passenger-carrying aircraft (14 CFR § 103.7(b)(6) and 14 CFR § 103.19(b)).

5. AIR CARRIER REQUIREMENTS IN HANDLING OF RADIOACTIVE MATERIALS PACKAGES. The following requirements must be complied with by carriers:

a. Certification - No aircraft operator may knowingly accept for shipment any package unless there is accompanying the shipment a clear and visible shipper's certification as described in paragraph 4.c.(6) above. The operator of the aircraft relies on the shipper's certificate as prima facie evidence that the packaging is in compliance with the regulatory requirements. (14 CFR § 103.3(a)). One signed copy of the shipper's certificate must accompany the shipment, with the originating air carrier to retain a second copy (14 CFR § 103.3(b)).

b. Transport Index Control.

(1) Each air carrier, aircraft operator, etc., must observe a storage control on accumulations of packages bearing either the "Radioactive-Yellow II" or "Radioactive-Yellow III" label (See Appendix 1). This control is based on the "transport index" (§ 173.389(i)) value which has been assigned to each package bearing a radioactive "yellow" label. This number will be inserted in the square block found in the lower half of the label. The total transport index (as determined by adding together the transport index number as shown on the labels of each individual package) may not exceed 50 on any single aircraft or in any specific terminal storage location. (14 CFR § 103.19(b)).

(2) The total transport index is also used to control the distances between packages bearing the yellow label and areas continuously occupied by persons or animals, or to any packages containing undeveloped film. A table which indicates the minimum separation distances, based on the variables of total transport index and transit time (or storage time) is indicated in § 14 CFR 103.23(a). In order to properly comply with this regulation, the aircraft operator (cargo-loading supervisor) must be careful to consider the particular physical arrangement (size, shape, volume) of the baggage or cargo compartment of the specific aircraft, as it concerns the positioning of the yellow-label packages relative to the nearest passengers. Since the vast majority of the radioactive materials packages will be small cartons (i.e., medical radioisotope shipments) the natural tendency will be to load such packages near the "top of pile" within the cargo compartment.2/

2/ It must be recognized that these storage distance limitations are designed to prevent damage to unexposed film, and to prevent "technical" exposures to radiation to the general public. Failure to observe such limits should not be construed to represent a situation where persons would be exposed to lethal or even moderately "dangerous" levels of radiation exposure.

c. Notification to Pilot. The aircraft operator must notify the pilot in command of the aircraft of the name, type of label, quantity, and location of any "dangerous article," such as radioactive materials packages. The cargo load manifest must be conspicuously marked to indicate the presence of such packages (14 CFR § 103.25).

acting Director
Flight Standards Service


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RADIOACTIVE
CONTENTS:
NO. OF CURIES:


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HANDLE CAREFULLY
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